

**In the Claims**

Please amend and add the claims as follows. Additionally, a listing of the current status for all of the claims in the above-identified application follows.

1. (Original) A cathode sub-assembly for a ion source comprising:  
an indirectly heated cathode; and  
a support rod fixedly attached to the indirectly heated cathode for supporting the cathode with an arc chamber of the ion source.
2. (Original) The cathode sub-assembly as defined in claim 1 wherein the support rod is attached to a surface of the cathode facing away from the arc chamber.
3. (Original) The cathode sub-assembly as defined in claim 2 wherein the cathode is in the shape of a disk.
4. (Original) The cathode sub-assembly as defined in claim 3 wherein the support rod is fixedly attached at or near the center of the cathode, along an axis of the cathode.
5. (Original) The cathode sub-assembly as defined in claim 4 wherein the support rod is in the shape of a cylinder and the diameter of the cathode is larger than a diameter of the support rod.
6. (Original) The cathode sub-assembly as defined in claim 5 wherein the diameter of the cathode is at least four times larger than the diameter of the support rod.
7. (Original) The cathode sub-assembly as defined in claim 5 further comprising a spring loaded clamp for holding the support rod.
8. (Original) The cathode sub-assembly as defined in claim 1 wherein the support rod mechanically supports and conducts electrical energy to the cathode.

9. (Previously presented) A cathode sub-assembly for use in an indirectly heated cathode ion source which includes an arc chamber housing that defines an arc chamber, comprising:

- a cathode sub-assembly, including a cathode and a support rod fixedly mounted thereto;
- a filament for emitting electrons, that is positioned outside the arc chamber in close proximity to the support rod of the cathode sub-assembly; and
- a cathode insulator for electrically and thermally isolating the cathode from an arc chamber housing, that is disposed around the cathode of the cathode sub-assembly.

10. (Previously presented) The cathode assembly as defined in claim 9 further comprising a filament disposed around the support rod in close proximity to the cathode and isolated from a plasma in the arc chamber.

11. (Previously presented) The cathode assembly as defined in claim 9 further comprising a filament disposed around the support rod in close proximity to the cathode and isolated from a plasma in the arc chamber, wherein the filament is fabricated of an electrically conductive material and includes an arc-shaped turn having an inside diameter greater than or equal to the diameter of the support rod.

12. (Previously presented) A cathode assembly for use in an indirectly heated cathode ion source which includes an arc chamber housing that defines an arc chamber, comprising:

- a cathode sub-assembly, including a cathode and a support rod fixedly mounted thereto;
- a filament for emitting electrons, that is positioned outside the arc chamber in close proximity to the support rod of the cathode sub-assembly; and
- a cathode insulator for electrically and thermally isolating the cathode from an arc chamber housing, that is disposed around the cathode of the cathode sub-assembly; and
- a filament disposed around the support rod in close proximity to the cathode and isolated from a plasma in the arc chamber, wherein the filament is fabricated of an electrically conductive material and includes an arc-shaped turn having an inside diameter greater than or equal to the diameter of the support rod, and wherein a cross-sectional area

of the filament varies along a length of the filament, and is smallest along the arc-shaped turn.

13. (Previously presented) A cathode assembly for use in an indirectly heated cathode ion source which includes an arc chamber housing that defines an arc chamber, comprising:

a cathode sub-assembly, including a cathode and a support rod fixedly mounted thereto;

a filament for emitting electrons, that is positioned outside the arc chamber in close proximity to the support rod of the cathode sub-assembly;

a cathode insulator for electrically and thermally isolating the cathode from an arc chamber housing, that is disposed around the cathode of the cathode sub-assembly;

wherein said cathode insulator includes an opening having a diameter that is larger than or equal to the diameter of the cathode.

14. (Original) The cathode assembly as defined in claim 13 wherein a vacuum gap is provided between the cathode insulator and the cathode to limit thermal conduction.

15. (Previously presented) The cathode assembly of claim 13 wherein said cathode insulator has a generally tubular shape with a sidewall and includes a flange, for shielding the sidewall of the cathode insulator from a plasma in the arc chamber.

16. (Previously presented) The cathode assembly of claim 15 wherein said flange is provided with a groove on a side of the flange facing away from the plasma, for increasing a path length between the cathode and the arc chamber housing.

17. (Original) A method for supporting and indirectly heating a cathode of an ion source comprising steps of:

supporting the cathode by a rod fixedly attached to the cathode; and  
bombarding the cathode with electrons.

18. (Previously presented) A cathode assembly for an ion source comprising:
- a cathode;
  - a support rod fixedly attached to the cathode;
  - a cathode insulator for electrically and thermally isolating the cathode from an arc chamber housing; and
  - an indirect heating device for indirectly heating the cathode.
19. (New) The cathode sub-assembly as defined in claim 1 wherein the support rod is press fitted to the indirectly heated cathode.
20. (New) The cathode assembly as defined in claim 9 wherein the support rod is press fitted to the cathode.
21. (New) The cathode assembly as defined in claim 12 wherein the support rod is press fitted to the cathode.
22. (New) The cathode assembly as defined in claim 13 wherein the support rod is press fitted to the cathode.
23. (New) The method as defined in claim 17 wherein the step of supporting comprises press fitting the rod to the cathode.
24. (New) The cathode assembly as defined in claim 18 wherein the support rod is press fitted to the cathode.
25. (New) A cathode sub-assembly for an ion source comprising:
- an indirectly heated cathode; and
  - a support rod press fitted to the indirectly heated cathode for supporting the cathode within an arc chamber of the ion source.